Commander's Predictive Environment (CPE)

18 March 2008

Dr. Janet Miller

Human Effectiveness Directorate

Air Force Research Laboratory

Linkage to USAF and Joint Warfighting Needs

* **"The future total force must be not only adaptable to today's fight, but also tomorrow's fight and *equally adaptable to unknown applications."***

General T. Michael Moseley
USAF Perspectives, Fall 2005

* **...*achieving a culture of prediction*…..the vast, untapped warfighting potential…..to *anticipate the evolution of the battlespace* in order to pre-empt, influence, and decisively defeat their adversaries…..*technological progress is still required* to actualize a culture of prediction…"**
USAF SAB, Predictive Battlespace Awareness to Improve Military Effectiveness
July 2002, Maj Gen George B. Harrison, USAF (Retired), Study Chair

* **"The best that one can hope for is that careful planning will *reduce the degree of uncertainty* confronted by senior defense decision-makers, and *provide them with options for hedging against an unpredictable future."***

Andrew F. Krepinevich, Center for Strategic & Budgetary Assessments
QDR Testimony, US House of Representatives, 14 Sep 05

On 'Prediction'

> **Even if someone knew the entire physical history of the world, and every mental event were identical with a physical, it would not follow that he could predict or explain a single mental event (so described, of course).**
>
> **Donald Davidson**

Prediction is hard. Especially about the future.
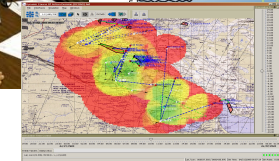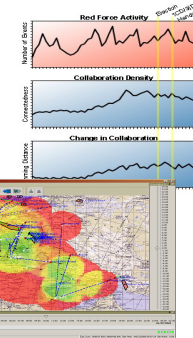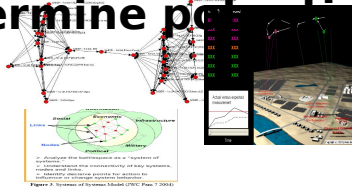**Yogi Berra and others**

Prediction, Anticipation, Foresight….

Commander's Predictive Environment (CPE)

- **CPE Goal: Provide near real-time analysis and decision support for _understanding_ the mission space, _anticipating_ enemy intent, actions and emerging threats and _determining_ potential courses of action.**

- Model the environment to enable anticipation

- Determine potential red and blue COA

CPE

- Analyze, plan & forecast
- Projection of plausible "future states"

- Interactive capability to conduct "what if" analysis and COA evaluation
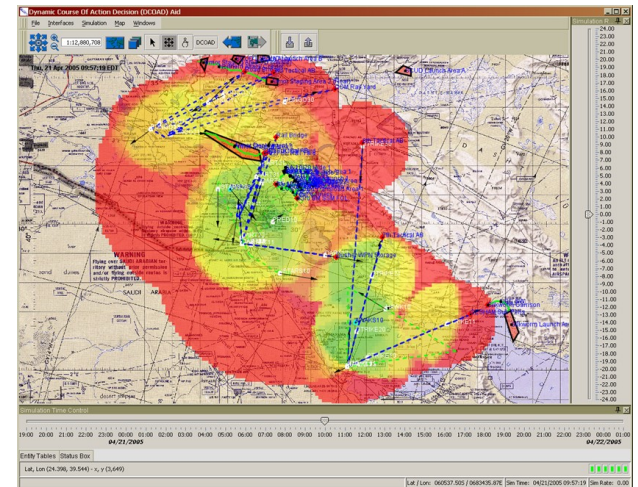
- Operational simulations for mission training, rehearsal and sensitivity analyses

COA = Course of Action

Anticipatory Environments

- ## Anticipate an adversary's moves as well as our own needs to own/shape the battlespace

  - Physical space, cyberspace
  - Past, present, future
  - Friend, foe, neutral
    - Culture, behavior, goals, needs……

Anticipating Human Actions

- **In near peer scenarios we are looking at <u>traditional targets</u> (weapons, military facilities, LOC)**

- **In UW scenarios we are (primarily) looking at <u>soldiers and vehicles</u> (and are very concerned about collateral effects)**

- **In GWOT we are (primarily) looking at <u>people</u>**

Anticipating the actions of people is different from anticipating the movement of a missile battalion; it requires different technology

Potential Parameters

Behavioral

- **Cultural Imperatives/Values**
- **Religion &/or Ideology**
- **Race/Ethnicity/Nationality**
- **Training/Education**
- **Personality**
- **Political Affiliation**

Situational

- **Specific activities**
- **Gathering information**
- **Purchasing specific items**
- **Travel to select locations**
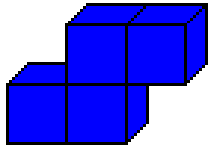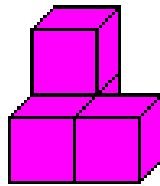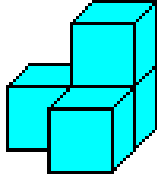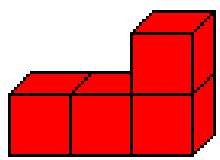- **Association with other actors**

"Geography, tribal structure, religion, social customs, language, appetites, standards—all were at my fingertips. The enemy I knew almost like my own side."
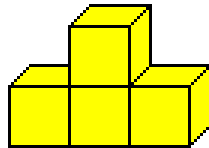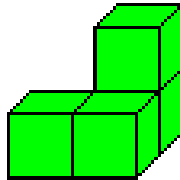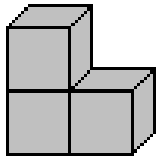
T. E. Lawrence
"Lawrence of Arabia"
British Army Officer and Middle East Subject Matter Expert WWI
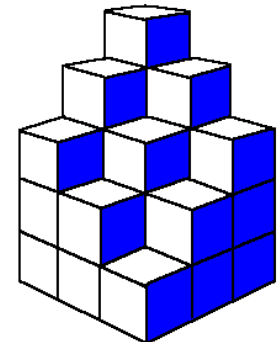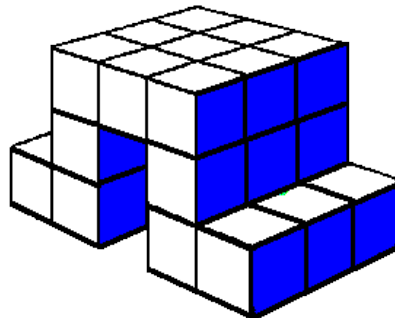
How Does One Turn Data into Knowledge?
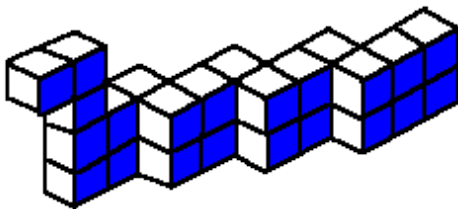
Data:

- **Data:**
  - Isolated patterns, facts, beliefs, propositions
- **Information:**
  - Data in context
- **Knowledge:**
  - Contextualized information combined with existing knowledge

"Behavior signatures" -- a class of models that provides context, or a way to interpret data:
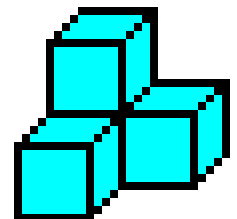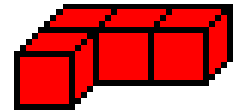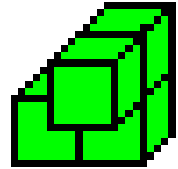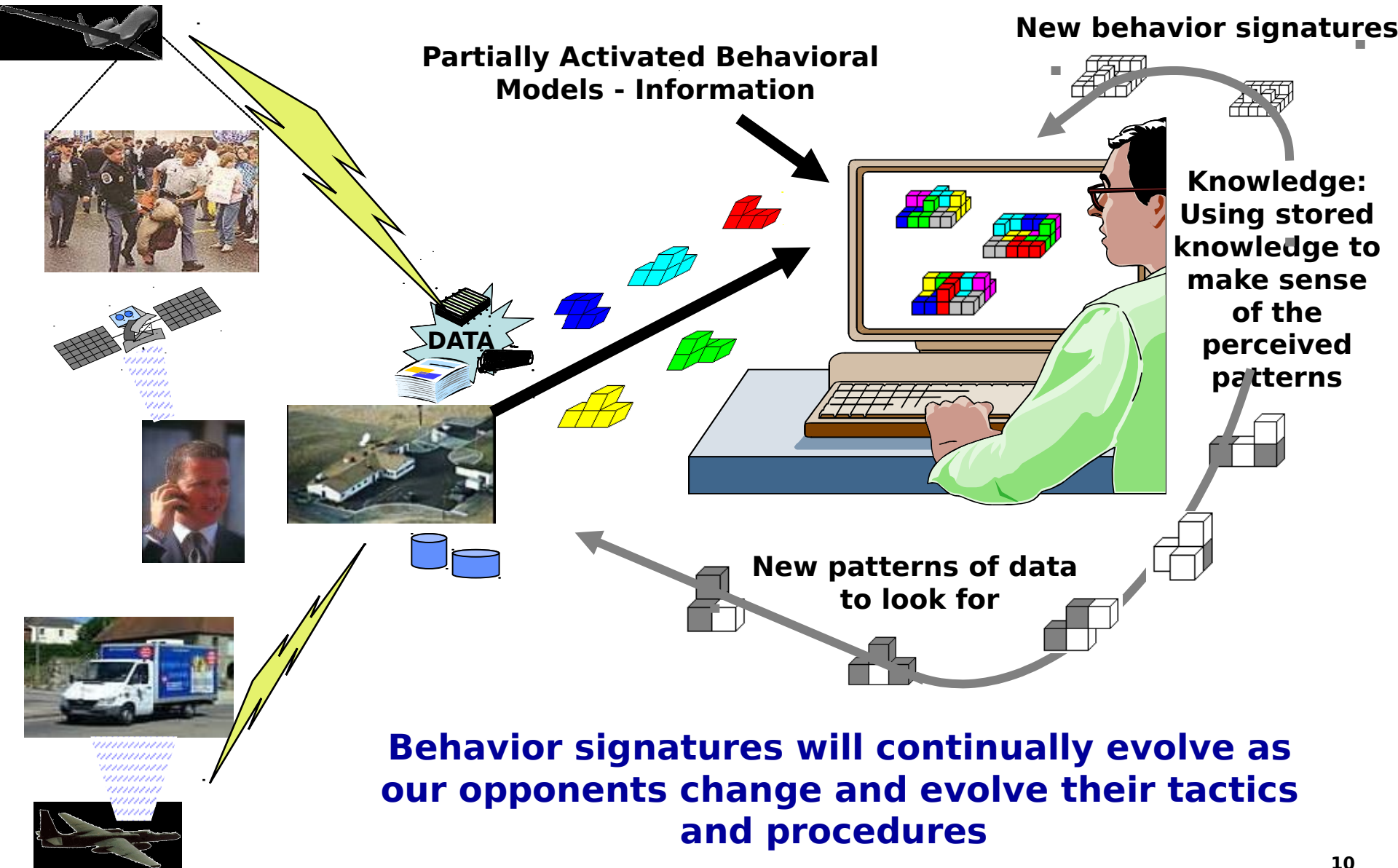
Behavioral Models

- **Organized structure whose components are a set of variable slots that are filled or instantiated by data**

- **Models combine**

  - **Arriving data**

  - **Existing knowledge of adversary**

- **Partial match of slot variables activate schema**

- **Once active, the model attempts to fill remaining slots**

  - **Provide guidance for intelligent sensor cuing and data analysis**

- <u>**Models provide the structure for behavioral signatures**</u>
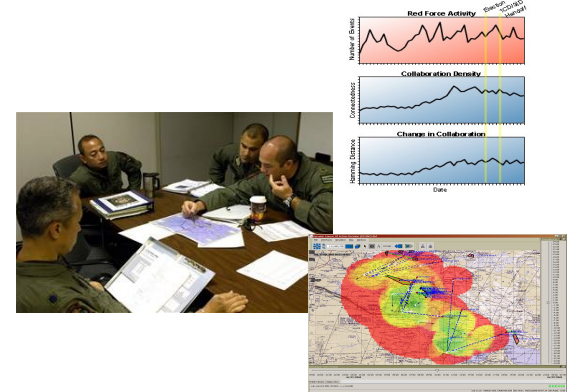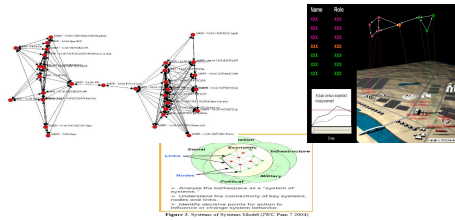
Sensemaking Support Environment

Partially Activated Behavioral Models - Information

New behavior signatures

DATA

Knowledge: Using stored knowledge to make sense of the perceived patterns

New patterns of data to look for

Behavior signatures will continually evolve as our opponents change and evolve their tactics and procedures
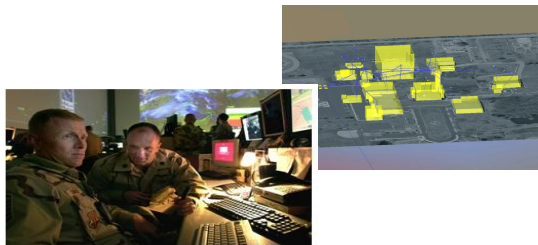
CPE Focus

- **Model the environment to enable anticipation**
- **Determine potential red and blue COA**

CPE

- **Analyze, plan & forecast**
- **Projection of plausible "future states"**

- **Interactive capability to conduct "what if" analysis and COA evaluation**
- **Operational simulations for mission training, rehearsal and sensitivity analyses**

Never express yourself more clearly than you are able to think.

Niels Bohr

Questions?

Dr.Janet E. Miller
AFRL/RH
937.237.9418